APPENDIX 1 - ON-ROAD HEAVY-DUTY VEHICLES

Below is additional information pertaining to the On-Road Heavy-Duty Vehicle (HDV) category under AQMD's FY 2005 Carl Moyer Program (CMP). All information in RFP# P2006-01 and this Appendix apply. For additional detail regarding this program category, refer to CARB's 2003 CMP Guidelines[1]. In the case of any conflict between CARB guidelines and AQMD criteria, the more stringent criteria will prevail.

Applicants are further cautioned that CARB is currently considering adoption of the South Coast Fleet Rules (scheduled for Board consideration in September 2005) for refuse haulers, school buses and urban transit buses. Depending on the outcome of this action, these vehicles may no longer be eligible for Moyer Program funding. Projects will be evaluated on a case-by-case basis to determine if there are any surplus emissions that remain eligible for Moyer Program incentives.

It is the Applicant's responsibility to check with AQMD's CMP web page for program clarifications, changes and updates. This page may be accessed by clicking the "Clean Air Technologies" link on AQMD's home page at http://www.aqmd.gov/tao/implementation/carl_moyer_program_2001.html.

INTRODUCTION

Vehicles greater than 14,000 pounds (lbs) gross vehicle weight rating (GVWR) are considered to be HDVs, which can be categorized further as medium heavy-duty (MHD) and heavy heavy-duty (HHD) vehicles. Specific vehicle weight classes are delineated below:

Vehicle Class	Weight Class	Category
Class 4	14,001 – 16,000	MHD
Class 5	16,001 – 19,500	MHD
Class 6	19,501 – 26,000	MHD
Class 7	26,001 – 33,000	MHD
Class 8	33,001 +	HHD

[1] Be sure to visit www.arb.ca.gov/msprog/moyer/moyer.htm for the latest approved CARB CMP Guidelines.

PROGRAM GUIDELINES/CRITERIA

Highlights for 2005

- Cost-effectiveness calculations will now be based on particulate matter (PM10), oxides of nitrogen (NOx), and reactive organic gases (ROG). The new formula[2] established by CARB is provided below:

$$\frac{\text{Annualized Cost (\$/year)}}{\text{NOx reductions + 10(combustion PM10 reductions) + ROG reductions (tons/year)}}$$

AQMD staff will calculate the NOx, PM and ROG emissions reductions and apply the new formula during the evaluation process.

- Applicants **must** provide vendor quotes with their application to document the incremental cost of implementing the proposed technology. This will require documentation of both the baseline and low-emission project costs. Applicants can request funding up to the full differential cost between a low-emission vehicle/engine/equipment option and its new non-low emission equivalent; however, less may actually be awarded, depending on the results of the cost-effectiveness evaluation.

- Applicants must also provide documentation that justifies the activity level projected for the vehicles (i.e., mileage logs, hour-meter records, business records, fuel receipts, etc.). Projects that request a fuel-based calculation must provide fuel receipts for the past two years to justify the fuel consumption activity projected for the vehicle.

- All projects must be operational within twelve (12) months of contract execution.

- The minimum project life is reduced from five (5) to three (3) years.

- Particulate filters and diesel oxidation catalysts are eligible for funding. These engine retrofit devices must be verified to reduce NOx emissions by at least 15 percent compared to the original engine certification level.

Project Eligibility Criteria

In general, on-road vehicle projects qualifying for evaluation must meet the following criteria:

[2] CARB's new formula also includes "non-combustion PM". AQMD will include this as appropriate, once more information (i.e., emission factors) become available from CARB.

- Eligible project types include new vehicle purchases, vehicle engine replacement (repower), and engine retrofit, with the exception that no repower or retrofit projects in the transit category are eligible.

- Only alternative fuel projects are eligible. No diesel-to-diesel projects are eligible in the on-road vehicle category.

- New vehicle purchase projects must provide at least 30 percent NOx emission reduction compared to baseline NOx emissions. Baseline NOx emissions correspond to a new engine meeting current applicable emission standards.

- Alternative fuel repower or retrofit projects must provide at least 15 percent NOx emission reductions.

- For fuel-based calculations, NOx emission levels shall be determined by multiplying 0.95 to the certified NOx+NMHC emission standard for diesel engines and by 0.80 for alternative fuel engines.

- For diesel engines only, multiply the base NOx emission rate (in either g/mi or g/bhp-hr) by the appropriate fuel correction factor shown in Table 1.8, in addition to other calculation adjustments. **Note that this would only be required when determining the baseline emissions for the project.**

- For new vehicle purchase projects, engines designated for participation in any averaging, banking, and trading (AB&T) program, i.e., engines that were certified to a Family Emission Limit (FEL) level are **not** eligible to participate in the Carl CMP.

- Another possible repower option is the use of an engine that was certified to a Family Emissions Limit (FEL) level as the replacement engine. For repowers only, engines certified to an FEL that is lower than the required emission standard are eligible to participate in the CMP. For calculation purposes, the required emission standard shall be used to determine emission reductions, **not** the FEL. Any emissions below the standard have already been used by the engine manufacturer to meet the FEL. By using the required emission standard, double counting of emission reductions will be avoided.

- For repower projects, engines manufactured after September 30, 2002, must be certified to at least the 2.4 g/bhp-hr NOx+NMHC, or 2.5 g/bhp-hr NOx+NMHC with a 0.5 g/bhp-hr NMHC cap.

- The newer replacement engine used in vehicle repower projects could be either a new, rebuilt, or remanufactured engine. Eligible rebuilt or remanufactured engines are those offered by the OEM or by a non-OEM rebuilder that demonstrates to the ARB that the rebuilt engine and parts are functionally equivalent from an emissions and durability standpoint to the OEM engine and components being replaced.

- Reduced-emission alternative fuel engines for repowers or alternative fuel retrofit kits must be certified by CARB for sale in California and must comply with durability and warranty requirements. Qualified engines could include new CARB-certified engines; CARB-certified aftermarket part engine/control devices; or engines with CARB-approved experimental permits.

- Funded projects must operate for a minimum of three (3) years. At least 75 percent of vehicle annual miles traveled must occur within AQMD boundaries, except for inter-district alternative fuel vehicles, which will be evaluated on a case-by-case basis.

- Projects must not exceed a cost-effectiveness of $13,600 per ton of emissions (NOx + ROG + 10*PM) reduced.

- On-road HDV projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the air district suggests potential, surplus, real, quantifiable, and enforceable emission reduction benefits.

- Recently the California Air Resources Board adopted changes to the urban transit bus rule. The eligibility requirements for alternative-fuel[3] urban transit buses are reflected below:

    - Projects must meet all other requirements of the urban bus regulation and the Carl Moyer Program Guidelines.

    - A 2.4 g/bhp-hr NOx baseline may be used for all purchases of new alternative-fuel urban transit bus engines through the 2006 model year.

    - Project must reduce emissions by 30 percent over the 2.4 g/bhp-hr NOx+NMHC standard **or**

    - Meet an optional, reduced-emission standard for urban transit buses (0.3 to 1.8 g/bhp-hr for 10/2002 to 2006 model years).

Evaluation Methodology

AQMD staff will evaluate all submitted proposals and make recommendations to the Governing Board for final selection of project(s) to be funded. Proposals will be evaluated based on the cost-effectiveness of emissions (NOx + ROG + 10*PM) reduced on an equipment-by-equipment basis, as well as a project's "disproportionate impact" evaluation (discussed below). Be aware of the possibility that due to program priorities

[3] *Alternative fuel includes gasoline (when used in hybrid electric buses only) under the urban transit bus regulations.

and/or funding limitations, project applicants may be offered only partial funding, and not all proposals that meet minimum cost-effectiveness criteria may be funded.

In compliance with AB 1390, Firebaugh, the FY 2005 CMP requires that at least 50 percent of the funds be spent in areas that are disproportionately impacted by air pollution. CARB has issued broad goals and left the details of how to implement this requirement to each air agency. In the South Coast Air Quality Management District, the disproportionately impacted areas are defined by a weighted formula that includes poverty level, particulate matter (PM) exposure and toxic exposure. The process is described below:

1. All projects must qualify for the CMP by meeting the cost-effectiveness limits established in the RFP.

2. All projects will be evaluated according to the following criteria to qualify for Disproportionate Impact funding:

    a. Poverty Level: All projects in areas where at least 10 percent of the population falls below the Federal poverty level based on the year 2000 census data, will be eligible to be included in this category, and

    b. PM Exposure: All projects in areas with the highest 15 percent of PM concentration will be eligible to be ranked in this category. The highest 15 percent of PM concentration is 46 micrograms per cubic meter and above, on an annual average, or

    c. Toxic Exposure: All projects listed in the Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES II) report[4] as having a cancer risk of 1,000 in a million and above will be eligible to be ranked in this category.

    Data for the poverty level and PM and toxic exposures were obtained from the U.S. Census, the 1998 AQMD monitoring data and Mates II study respectively.

3. Fifty percent of the $18.6 million available for this RFP will be allocated among proposals located in disproportionately impacted areas. If the funding for disproportionately impacted areas is not exhausted with the outlined methodology, then staff will return to the Governing Board for direction. If funding requests exceed 50 percent of the total available funding, then all qualified projects will be ranked based on their disproportionate impact. Each project will be assigned a score that is comprised of 40 percent for poverty level, and 30 percent each for PM and toxic exposures. Proposals with the highest scores will receive funding until 50 percent of the total funding is allocated.

    All the proposals not awarded under the fifty percent disproportionate impact funding analysis will then be ranked according to cost-effectiveness, with the

[4] Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES II), SCAQMD, March 2000.

most cost-effective project funded first and then in descending order for each funding category until the remainder of the Moyer Funds are exhausted. Some projects that exceed the cost-effectiveness ceiling may receive partial funding, depending on their rankings.

Eligible Costs

Eligible project costs (i.e., costs for which Moyer funding is requested) are limited to the incremental cost of a project to implement the reduced emission technology. Operation and maintenance costs are not eligible for CMP funding. Please refer to the Project Types section below for additional detail.

Reporting and Monitoring

All participants in the CMP are required to keep appropriate records during the full contract period (minimum of 3 years). Records must be retained and updated throughout the project life and made available for AQMD inspection. Project life is the number of years used to determine the cost-effectiveness. All equipment must operate in the AQMD for this full project life. The AQMD may conduct periodic reviews of each project's operating records to ensure that the engine is operated as stated in the program application. Annual records must contain, at a minimum:

- Total miles traveled
- Total miles traveled in the South Coast Air Basin
- Annual fuel consumed
- Maintenance and repair information

Records must be retained and updated throughout the project life and made available for AQMD inspection. The AQMD may conduct periodic reviews of each heavy-duty vehicle project's operating records to ensure that the vehicle is operated as required by the project requirements.

PROJECT TYPES

New Vehicles

For new vehicle projects, the new vehicle/engine must be certified to one of CARB's current optional NOx emission credit standards, regardless of fuel type or engine design. Prior to October 1, 2002, CARB's optional credit standards were based on NOx emissions only. As of October 1, 2002, the optional credit standards are based on combined NOx+NMHC emissions. The current emissions credit standards start at 1.8 g/bhp-hr NOx+NMHC and decrease in 0.3 g/bhp-hr increments. Engines not certified to CARB's NOx+NMHC emission credit standards are not eligible to participate in the CMP. Please refer to Table 1.1 for a summary of HDV exhaust emission standards. Table 1.2 provides the default NOx factors which are utilized to get NOx only emission factors from the combined standards. Table 1.3 lists the heavy-duty engines that were certified to CARB's optional NOx+NMHC emission credit standards as of April, 2004.

Since new engines are certified on an ongoing basis, visit http://www.arb.ca.gov/msprog/moyer/certeng.htm or contact CARB staff for the most current list of eligible engines. For repower projects, engines that are certified to an FEL NOx or NOx+NMHC level that is lower than the required emission standard are eligible. The emission level that can be used in Moyer calculations for these engines would be the applicable emission standards and not the FEL levels.

Transit Bus Projects

It is noteworthy that purchases of new transit buses must be beyond the requirements of CARB's Urban Transit Bus Rule. Thus, applicants must submit evidence of compliance with CARB's transit bus rule or documentation to support that CMP funds will not be used to meet CARB transit rule regulatory requirements.

Repowers

Vehicle repower refers to the replacement of an existing engine with a newer engine certified to lower emission standards. Repowering is allowed only for projects that replace the existing diesel engine with an alternative fuel engine. The replacement engine must be certified for sale in California to a NOx emission standard that is at least 15 percent lower than the original engine NOx certification level for the engine being replaced. The CMP will fund up to the differential cost to repower the vehicle with a new alternative fuel engine instead of a new diesel engine.

For the AQMD's CMP, eligible HD diesel-to-alternative fuel engine repower projects are those that replace uncontrolled mechanical engines with emission-controlled mechanical engines that meet the 15 percent minimum NOx reduction requirement. For mechanical-to-mechanical engine repowers, an applicant must provide AQMD with the vehicle identification number (VIN), engine model number, and serial number. This will be provided to CARB, which will then determine the project's eligibility. Electronic-to-electronic engine repowers are also allowed when replacing a 1988 and later model year electronic engine with an alternative fuel engine. Of course, all other eligibility criteria must be met.

Although substantial NOx emission reductions may occur by repowering a pre-1987 mechanical engine with an engine manufactured on or after October 1, 2002, installation of an alternatively-fueled, electronically-controlled engine into a mechanical engine platform is difficult due to significant fuel and electrical system differences. **Thus, mechanical-to-electronic engine repower projects will be considered on a case-by-case basis by AQMD and CARB.**

It is noteworthy that engines that were certified to FEL levels higher than the applicable required emission standards are not eligible for participation in the CMP.

Retrofits

Retrofit involves modifications to an engine and/or fuel system such that the retrofitted engine does not have the same specifications as the original engine. Retrofit projects are allowed for all engine model years, regardless of mechanical or electronic control. The most straightforward retrofit projects are those that are conducted at the time of engine rebuild. Such a project may entail certain engine and/or fuel system component upgrade to result in a lower emission configuration. They may also include add-on aftertreatment. To qualify for funding, the engine retrofit kit must be verified to reduce NOx emissions by at least 15 percent compared to the original engine certification level. CARB has in place formal verification procedures for diesel emission control technology.

EMISSION REDUCTION AND COST-EFFECTIVENESS

Background

Engine emission standards have progressively and substantially reduced NOx and PM emissions from Heavy Duty Vehicles (HDVs) over time. NOx emissions from new HDVs were further reduced by one half in 2004. In addition, a number of heavy-duty engine manufacturers have entered into Settlement Agreements with CARB (under the federal Consent Decree) to correct off-cycle NOx emissions. Table 1.1 lists the existing and future NOx and PM emission standards for heavy-duty engines.

Table 1.1 – Exhaust Emission Standards for Heavy-Duty Engines

	NOx and PM Emission Standards (g/bhp-hr)[a]			
	Heavy-Duty Vehicles		**Urban Buses**	
Model Year	**NOx**	**PM**	**NOx**	**PM**
1996 - 2003	[--]	--	4.0	0.05 [b]
1998 - 2003	4.0	0.10	--	--
October 1, 2002[c]	2.4 [d] or 2.5 [e]	0.10	2.4[d] or 2.5[e]	0.05[b]
2004 - 2006	2.4 [d] or 2.5 [e]	0.10	2.4[d,f] or 2.5[e,f] 0.5[g]	0.03[f] 0.01[g]
2007 +	0.2	0.01	0.2	0.01

[a] g/bhp-hr = grams per brake-horsepower-hour
[b] in-use standard of 0.07 g/bhp-hr
[c] These standards are applicable to Settlement Agreements (Consent Decree) engines
[d] NOx plus Non-Methane Hydrocarbons (NMHC)
[e] NOx plus NMHC with 0.5 g/bhp-hr NMHC cap
[f] For Transit Agencies on the Alternative Fuel Path, these standards are applicable to alternative fuel engines
[g] For Transit Agencies on the Diesel Path, these standards are applicable to both alternative fuel and diesel engines; for Transit Agencies on the Alternative Fuel Path, these standards are applicable to diesel engines

As illustrated in Table 1.1, the emission standards for heavy-duty diesel engines changed in 2002 to a combined NOx+NMHC standard. In the CMP, new vehicle project eligibility is based on the cost-effectiveness of NOx reductions relative to the current baseline NOx+NMHC emissions of 2.5 g/bhp-hr. To determine the NOx fraction (NOx only) from the combined NOx+NMHC values, the certification NOx+NMHC emission standard for an engine is multiplied by the appropriate NOx fraction. A different NOx

fraction than the default values illustrated in Table 1.2 may be used if justified by proper documentation submitted to AQMD for case-by-case CARB consideration. The default NOx fraction values are appropriate for use where the available emission rates are given in terms of NOx+NMHC, such as those for alternative-fuel engines. For on-road heavy-duty diesel vehicles, where the emission factors are presented elsewhere in this chapter as a NOx emission rate based on EMFAC2002, use of the NOx fraction values will not be needed.

Table 1.2 – NOx Fraction Default Values

Diesel Engines	Alternative Fuel Engines
0.95	0.80

Executive Order Interpretation

CARB certifies engines destined for sale in California and provides the engine manufacturers with an Executive Order (EO) for each certified engine family. An example of an EO is shown in Figure 1.1. The EO includes general information about the certified engine such as engine family, displacement, horsepower rating(s), intended service class, and emission control systems. It also shows the applicable certification emission standards as well as the average emission levels measured during the actual certification test procedure. **For the purpose of the CMP, only the "Direct" emission standards are used in calculating emission benefits.**

The certification emission standards are shown in the row titled "(DIRECT) STD" under the respective "FTP" column headings for each pollutant. For instance, the Cummins 8.3 liter NG engine illustrated in Figure 1.1 was certified to a NOx+NMHC emission standard of 1.8 g/bhp-hr, a CO emission standard of 15.5 g/bhp-hr, and a PM emission standard of 0.03 g/bhp-hr.

In the case where an EO shows emission values in the rows labeled "AVERAGE STD" and/or "FEL", the engine is certified for participation in an AB&T program. AB&T engines (i.e., all FEL-certified engines) are not eligible to participate in the CMP for new vehicle purchase projects since emission benefits from an engine certified to an FEL level are not surplus. FEL-certified engine projects may participate in repower projects as discussed above.

Figure 1.1 – Sample Executive Order

California Environmental Protection Agency AIR RESOURCES BOARD	CUMMINS INC.	EXECUTIVE ORDER A-021-0340 New On-Road Heavy-Duty Engines

Pursuant to the authority vested in the Air Resources Board (ARB) by Health and Safety Code (HSC) Division 26 Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by HSC Sections 39515 and 39516 and Executive Order (EO) G-02-003; and

Pursuant to the December 15, 1998 Settlement Agreement (SA) between ARB and the manufacturer, and any modifications thereof to the Settlement Agreement;

IT IS ORDERED AND RESOLVED: That the engine and emission control systems produced by the manufacturer are certified as described below for use in on-road motor vehicles with a manufacturer's GVWR over 14,000 pounds. Production engines shall be in all material respects the same as those for which certification is granted.

MODEL YEAR	ENGINE FAMILY	ENGINE SIZE (liter)	FUEL TYPE (CNG/LNG=compressed/liquefied natural gas; LPG=liquefied petroleum gas)	STANDARDS & TEST PROCEDURE	INTENDED SERVICE CLASS (L/M/H HDD=light/medium/heavy heavy-duty [HD] diesel; UB=urban bus; HDO=HD Otto)
2003	3CEXH0505CBK	8.3	CNG / LNG	Diesel	UB

SPECIAL FEATURES & EMISSION CONTROL SYSTEMS	ENGINE MODELS / CODES (rated power in horsepower, hp)
TBI, OC, HO2S, TC, CAC, PCM	CG-280 / 8012 (280 hp), CG-275 / 8009 (275 hp), CG-250 / 8006 (250 hp), CG-250 / 8003 (250 hp)

GVWR=gross vehicle weight rating TWC/OC=three-way/oxidizing catalyst WU (prefix) =warm-up cat. O2S=oxygen sensor HO2S=heated O2S TBI=throttle body fuel injection MFI=multi port fuel injection SFI=sequentialMFI DDI/DI=direct /indirect diesel injection TC/SC=turbo/super charger CAC=charge air cooler EGR=exhaust gas recirculation AIR=secondary air injection PAIR=pulsed AIR SPL=smoke puff limiter ECM/PCM=engine /powertrain control module EM=engine modification 2 (prefix)=parallel (2) (suffix)=in series HC=hydrocarbon NMHC=non-methane HC NOx=oxides of nitrogen CO=carbon monoxide PM=particulate matter HCHO=formaldehyde g/bhp-hr=grams per brake horsepower-hour

The following are the exhaust emission standards (STD), or family emission limit(s) (FEL) as applicable, and certification levels (CERT) for this engine family under the "Federal Test Procedure" (FTP) (Title 13, California Code of Regulations, (13 CCR) Section 1956.1 (urban bus) or 1956.8 (other than urban bus)), and under the "Euro III Test Procedure" (EURO) in the Settlement Agreement, including EURO's "Not-to-Exceed" standard(s). "Diesel" CO certification compliance may have been demonstrated pursuant to Code of Federal Regulations, Title 40, Part 86, Subpart A, Section 86.091-23(c)(2)(i) in lieu of testing. (For flexible- and dual-fueled engines, the CERT values in brackets [ ] are those when tested on conventional test fuel. For multi-fueled engines, the STD and CERT values for default operation permitted in 13 CCR Section 1956.1 or 1956.8 are in parentheses.)

	EURO'S NOT-TO-EXCEED STD						NMHC: *		NOx: *		NMHC+NOx: 2.25		PM: 0.0375	
* = not applicable	HC		NMHC		NOx		NMHC+NOx		CO		PM		HCHO	
	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO
(DIRECT) STD	*	*	*	*	*	*	1.8	1.8	15.5	15.5	0.03	0.03	*	*
AVERAGE STD	*	*	*	*	*	*	*	*	*	*	*	*	*	*
FEL	*	*	*	*	*	*	*	*	*	*	*	*	*	*
CERT	*	*	*	*	*	*	1.7	1.4	2.0	1.3	0.01	0.005	*	*

BE IT FURTHER RESOLVED: That certification to the FEL(s) listed above, as applicable, is subject to the following terms, limitations and conditions. The FEL(s) is the emission level declared by the manufacturer and serves in lieu of an emission standard for certification purposes in any averaging, banking, or trading (ABT) programs. It will be used for determining compliance of any engine in this family and compliance with such ABT programs.

BE IT FURTHER RESOLVED: That the listed engine models have been certified to the FTP optional NOx, or NMHC+NOx as applicable, and PM emission standard(s) listed above pursuant to 13 CCR Section 1956.1 or 1956.8.

BE IT FURTHER RESOLVED: That for the listed engine models, the manufacturer has submitted the materials to demonstrate certification compliance with 13 CCR Sections 1965 (emission control labels), and 2035 et seq. (emission control warranty).

BE IT FURTHER RESOLVED: That the listed engine models are conditionally certified subject to the following conditions: (**1**) The SA is in effect; (**2**) The manufacturer is in compliance with all applicable California emission regulations, and all SA's applicable requirements and any modifications thereof; (**3**) This EO is void with respect to any engine within this family determined to have a defeat device as that term is defined in the test procedures and SA. Any engine produced under the voided EO remains subject to stipulated penalties under the SA. Such penalties would begin to accrue upon manufacture of the first engine under this EO; (**4**) This EO expires at midnight on December 31, 2002; (**5**) Production of any engine within this family under this EO is acceptance of all conditions in this EO; and (**6**) ARB reserves the right to disapprove certification of this family, or any families using the same or similar auxiliary emission control device (AECD) strategies as this family is employing, based on all available information.

The Bureau of Automotive Repair will be notified by copy of this Executive Order.
Executed at El Monte, California on this 2ND day of October 2002.

Allen Lyons, Chief
Mobile Source Operations Division

Table 1.3 provides a list of heavy-duty engines certified for sale in California as an update. Applicants are encouraged to visit CARB's web site at **http://www.arb.ca.gov/msprog/moyer/certeng.htm**, to get the latest information available.

Table 1.3 – 2003 and 2004 Model Year Heavy-Duty Engines Certified to ARB's Optional NOx Emission Credit Standards (Emission Levels for NOx and NOx + NMHC are in gm/bhp-hr and PM is in g/mile.) as of December, 2004

MY	Manuf.	Service Type[a]	Fuel Type	Displ (ltr)	Cert. Std. NOx	Cert. Std. NOx+NMHC[b]	PM[c]	HP
2004	Cummins	MHD	CNG/LNG	8.3		1.8	.07	250/275/280
2004	ISE	BUS	Gasoline/Hybrid	6.8		0.6	.043	310
2004	Deere	BUS	CNG/LNG	8.1		1.5	.043	250/275/280
2004	Deere	MHD	CNG/LNG	8.1		1.2	.023	250
2004	Deere	HHD	CNG/LNG	8.1		1.5	.026	275/280
2004	Ford	HDO	CNG	5.4		1.5	--	225
2003	Cummins	MHD	CNG/LNG	5.9		1.8	0.06	195/200/230
2003	Cummins	MHD	CNG/LNG	8.3		1.8	0.06	250/275/280
2003	Cummins	BUS	CNG/LNG	8.3		1.8	0.025	250/275/280
2003	Deere	MHD	CNG	8.1	2.5		0.06	250
2003	DDC	BUS	CNG	8.5		1.2	0.025	275/330
2003	Ford	HDO	CNG	5.4	0.5	1.5	--	225

[a] **Service Type:** MHD (Medium Heavy-Duty); HHD (Heavy Heavy-Duty); BUS (Urban Bus)

[b] The optional NOx + NMHC emission standard is effective for engines manufactured on or after October 1, 2003.

[c] PM emission levels are based on "In-Use" emissions data.

Emission Reduction Calculation Discussion

Baseline Emission and Default Factors

In general, the emission reduction benefit of a project represents the difference in the emission level of a baseline vehicle/engine and a reduced-emission vehicle/engine. In situations where the model year of the vehicle chassis and the model year of the existing engine are different, the newer of the two model years, of either the vehicle or the engine, shall be used to determine the baseline emissions for benefit calculations. The emission level is calculated by multiplying an emission factor, an activity level, and a conversion factor, if necessary.

Because conversion factors and the activity levels may be expressed in different units for the existing and replacement engines, it is recommended that emission levels for the baseline and reduced-emission vehicles/engines be calculated separately and then differences taken to determine emission reductions. For most on-road vehicles, the activity level is defined by the annual miles traveled as indicated by the vehicle odometer. However, refuse vehicles and street sweepers operating in predominantly stop-and-go applications are exceptions. In this case, the activity level shall be based on fuel use as indicated by actual annual fuel receipts or equivalent documentation, to be provided with the application. Emission reduction calculations shall be consistent with the type of records maintained over the life of the project.

The NOx emission factors have been updated to reflect the recently adopted EMFAC2002 emissions model. Appropriate NOx emission factors as a function of vehicle type and model year are provided below in Tables 1.4, 1.5, and 1.6. For school bus projects, emission factors must be determined according to GVWR. If the emission factors in Tables 1.4, 1.5, and 1.6 are used, it is not necessary to apply the default NOx fractions listed in Table 1.2 since the emission factors in Tables 1.4, 1.5, 1.6 and 1.12 are already listed in terms of NOx-only emissions.

If fuel consumption is the basis for emission reduction calculations, a unit conversion factor is needed to translate g/mi to g/bhp-hr. The conversion factors listed below in Table 1.10 should be used for this conversion.

Table 1.4 – NOx Emission Factors for Medium Heavy-Duty Vehicles 14,001 - 33,000 lbs GVWR

Model Year	Grams per Mile
Pre – 1983	18.5
1984 – 1986	17.9
1987 – 1990	15.7
1991 – 1993	13.1
1994 – 1997	11.5
1998 – 2002	10.5
2003 +	5.8
2004 – 2006	5.5
2007+	0.5

Table 1.5 – NOx Emission Factors for Heavy Heavy-Duty Vehicles 33,000 + lbs GVWR

Model Year	Grams per Mile
Pre – 1975	28.5
1975 – 1983	27.2
1984 – 1986	20.2
1987 – 1990	16.8
1991 – 1993	16.0
1994 – 1997	19.1
1998	23.0
1999 – 2002	13.4
2003 – 2006	6.7
2007+	0.7

Table 1.6 – NOx Emission Factors for Urban Buses

Model Year	Grams per Mile
Pre – 1987	46.2
1987 – 1990	40.2
1991 – 1993	25.5
1994 – 1995	29.8
1996 – 1998	39.2
1999 – 2002	20.4
2003	10.2
2004 – 2006	2.5
2007+	1.0

Tables 1.7, 1.8, and 1.9 provide the PM emission factors for diesel-powered medium HDVs, heavy HDVs, and urban buses, respectively. Emission factors for school buses and neighborhood refuse are based on GVWR. For alternative-fueled urban transit buses, existing in-use test data shows that PM in-use emissions are 30% to 50% lower for a natural gas bus certified to the 0.03 g/bhp-hr PM standard than for a diesel bus engine certified to the 0.01 g/bhp-hr PM standard. Thus, alternative-fueled urban transit bus projects can use a 0.025 g/mile PM emission factor.

Applicants are cautioned that upon ARB Adoption of the South Coast Fleet Rules (scheduled for CARB Board consideration on September 22-23, 2005) for Refuse Haulers, School Buses and Urban Transit Buses, funding may not longer be eligible as emissions from those projects may no longer be surplus.

Table 1.7 PM Emission factors for Medium Heavy-Duty Vehicles 14,001 – 33,000 lbs GVWR

Model Year	g/mile
Pre - 1984	1.1
1984 - 1986	1.0
1987 - 1990	0.7
1991 - 1993	0.4
1994 - 1997	0.3
1998 - 2002	0.2
2003 - 2006	0.3
2007+	0.03

Table 1.8 PM Emission factors for Heavy Heavy-Duty Vehicles 33,000 + lbs GVWR

Model Year	g/mile
Pre - 1975	2.0
1975 - 1983	1.8
1984 - 1986	1.2
1987 - 1990	0.8
1991 - 1993	0.5
1994 - 1998	0.3
1999 - 2002	0.2
2003 – 2006	0.3
2007 +	0.03

Table 1.9 PM Emission factors for Urban Buses

Model Year	g/mile
Pre - 1987	1.3
1987 - 1990	1.2
1991 - 1993	1.1
1994 - 1995	1.4
1996 - 1998	1.7
1999 - 2002	0.6
2003+	0.1

Applicants are further cautioned that CARB is currently considering adoption of the South Coast Fleet Rules (scheduled for Board consideration in September 2005) for refuse haulers, school buses and urban transit buses. Depending on the outcome of this action, these vehicles may no longer be eligible for Moyer Program funding.

Projects will be evaluated on a case-by-case basis to determine if there are any surplus emissions that remain eligible for Moyer Program incentives.

Table 1.10 – Diesel Equivalent Conversion Factors for Heavy-Duty Vehicle Projects (bhp-hr/mile)

Model Year	Medium Heavy-Duty Diesel 14,001-33,000 lbs.	Heavy Heavy-Duty Diesel 33,000 lbs. +	Urban Transit Bus [a] 33,000 lbs. +
Pre-1978	2.3	2.9	4.3
1978 - 1981	2.3	2.8	4.3
1982 - 1983	2.3	2.8	4.3
1984 - 1990	2.3	2.7	4.3
1991 - 1995	2.3	2.7	4.3
1996+	2.3	2.6 [b]	4.3

a. Urban transit buses over 33,000 gross vehicle weight rating (GVWR) or school buses over 33,000 GVWR in an urban area.
b. 2.6 bhp-hr/mile is for all heavy-duty line haul trucks (Class 8).

California Fuel Correction Factor

The use of California's diesel fuel since 1993 (0.05 percent sulfur content by weight and 10 percent aromatic content by volume) would result in fewer NOx and PM emissions from diesel engines compared to the base emission rates. Base emission rates for diesel engines, as embodied in EMFAC2002 and presented in Tables 1.4, 1.5, and 1.5 above, were derived from test data using either federal diesel fuel (0.05 percent sulfur content by weight) or pre-1993 diesel fuel. Thus, a California fuel correction factor (CA-FCF) needs to be applied to the base emission rate to more accurately reflect the emissions from diesel engines when those engines are operated using California diesel fuel. Table 1.11 shows the CA-FCFs to be used for diesel engines.

Table 1.11 – California Diesel Fuel Correction Factors (CA-FCFs)

Model Year	NOx	PM
Pre – 1991	0.94	0.80
1991-1993	0.87	0.69
1994+	0.87	0.90

Stop-and-Go Vehicle Discussion

Refuse vehicles and street sweepers operating predominantly in stop-and-go applications accrue low mileage; yet intermittently operate at high load during compaction or sweeping mode. Therefore, a gram per mile (g/mi) emission factor may not be appropriate for these types of vehicles. Furthermore, based on discussion with engine manufacturers, neighborhood refuse collection trucks are subject to limited off-cycle emissions. In an effort to improve the quantification of emissions, NOx emission

factors for refuse vehicles and street sweepers operating predominantly in stop-and-go applications are listed in Table 1.12. These emission factors should be utilized when calculating emission reductions based on fuel consumption (only approved for stop-and-go applications). An applicant may use the g/mi emission factors for stop-and-go vehicle applications on a case-by-case basis, provided sufficient supporting documentation is submitted for review and approval by AQMD and CARB.

Table 1.12 – NOx and PM Emission Factors (g/bhp-hr) for Refuse Vehicles and Street Sweepers Predominantly in Stop-and-Go Applications (g/bhp-hr)

Model Year	NOx	PM
Pre – 1987	10.0	0.60
1987 – 1990	6.0	0.60
1991 – 1998	5.2	0.10
1999 – 2002	4.4	0.10
2003 – 2006	2.5	0.10
2007+	0.2	0.01

When annual fuel consumption is the basis for the emission reduction calculations, an energy consumption factor (ECF) is used to convert g/bhp-hr to grams of emissions per gallon of fuel used (g/gal). HD diesel engines typically have a brake-specific energy consumption of 6,500 to 7,000 BTU/hp-hr on the certification cycle. Diesel fuel has an energy density of approximately 18,000 BTU/lb and a mass density of 7 lb/gal. This results in the default ECF summarized in Table 1.13 and calculated as follows:

*(18,000 BTU/lb) * (7lb/gal) / ~6,800 BTU/hp-hr = 18.5 hp-hr/gal*

Table 1.13 – Default Energy Consumption Factor for On-Road Vehicles

Energy Consumption Factor	18.5 bhp-hr/gal

This factor may be used for refuse vehicles and street sweepers operating predominantly in stop-and-go applications. An engine specific ECF may be determined by: 1) dividing the horsepower rating of an engine by its fuel economy given in units of gal/hr or 2) dividing the energy density of the fuel (in units of BTU/gal) by the brake-specific fuel consumption of the engine.

The ECF combines the effects of engine efficiency and the energy content of the fuel used in that engine into an approximation of the amount of work output by the engine for each unit of fuel consumed. For alternative-fuel HD engines, the ECFs will vary depending on the engine efficiency and the energy density of the alternative fuel used in those engines. Since the efficiency of alternative fuel HD engines is approaching that of

a diesel engine, their ECFs can be assumed to be of similar values to a diesel engine ECF on a diesel equivalent basis. Thus, for simplicity, CARB recommends that the ECF of 18.5 hp-hr/gal for diesel engines, as derived above, also be used for alternative fuel HD engines in conjunction with fuel consumption in terms of diesel gallons.

If an applicant proposes to use a different ECF that would be specific to an alternative fuel engine, (i.e., liquefied natural gas engine), the applicant must provide supporting documentation to justify the proposed ECF. Typically, documentation is expected to include information on brake-specific energy consumption of the alternative fuel engine and energy density of the alternative fuel. For example, if LNG has an energy density of approximately 75,000 BTU/gal and an LNG engine is 95 percent efficient relative to a diesel engine with a brake-specific energy consumption of 6,800 BTU/hp-hr, the brake-specific energy consumption for the LNG engine is approximately 7,160 BTU/hp-hr (i.e., 6,800 BTU/hp-hr / 0.95). The ECF for this LNG engine is given as 75,000 BTU/gal / 7,160 BTU/hp-hr = 10.5 hp-hr/gal of LNG. This ECF would then be used to calculate emissions from the LNG engine.

While actual fuel receipts or other appropriate documentation support the annual fuel consumption of the baseline engine, the annual fuel consumption of the replacement reduced-emission engine may be estimated in proportion to the change in the ECF. For example, a replacement reduced-emission LNG engine having an ECF of 10.5 hp-hr/gal as discussed above, which replaces an existing diesel engine with a fuel use of 10,000 gal/yr and an ECF of 18.5 hp-hr/gal would have an estimated equivalent annual fuel consumption of 17,619 gallons/year or

*(10,000 gal/yr) * (18.5 hp-hr/gal) / (10.5 hp-hr/gal) = 17,619 gal/yr*

The outcome of both approaches, default vs. custom ECFs, can be compared. For an LNG engine certified to the 2.0 g/bhp-hr NOx emission standard and having an annual fuel consumption of 10,000 gal/yr of diesel fuel based on historical data for similar diesel engines, the emissions can be calculated in one of two ways, as follows:

1. Use of diesel ECF of 18.5 hp-hr/gal:
Annual emissions – (2.0g/bhp-hr)(18.5hp-hr/gal)*(10,000 gal/yr) = 370,000g/yr*

2. Use of LNG ECF of 10.5 hp-hr/LNG gal:
Estimated annual LNG consumption = 17,619 LNG gal/yr (see discussion above)
Annual emissions – (2.0 g/bhp-hr)(10.5 hp-hr/gal)*(17,619 LNG gal/yr) = 369,999 g/yr*

Refuse vehicles and street sweepers often have two engines, one for motive power and one for auxiliary operations. Emission benefits are calculated individually for each engine using fuel consumption rates for each unit if available. If the information is not available, the applicant must provide and document an estimate for the typical activities of each engine based on best engineering judgment so that emission can be determined. Factors such as fuel economy, typical operating loads, and hours of operation for each engine must be provided. Alternatively, a default assumption of two-thirds and one-third split of the total fuel consumed for the main engine and auxiliary

engine, respectively, may be used. Future fuel receipts or equivalent documentation should be submitted to the AQMD annually throughout the project life for verification.

Retrofit Devices

Table 1.14 provides the verification classifications for diesel emission control strategies.

Table 1.14 Verification Classifications for Diesel Emission Control Strategies

Pollutant	Reduction	Classification
PM	< 25%	Not verified
	≥ 25%	Level 1
	≥ 50%	Level 2
	≥ 85%, or ≤ 0.01 g/bhp-hr	Level 3

Only designated engine families for specified model years are compatible with CARB-verified diesel exhaust after-treatment devices. CARB certification levels and information is continually being updated. Applicants are required to submit verification letters as part of the application. Verification letters as well as current information can be found at www.arb.ca.gov/diesel/verdev/verdev.htm.

The program will fund the cost of purchase and installation of a CARB-verified diesel particulate filter, up to a maximum of $8,500, or CARB-verified diesel particulate matter plus NOx after-treatment device, up to a maximum of $18,000. These maximum awards are also subject to the overall Moyer Program cost-effectiveness limit of $13,600 per ton of emissions reduced.

Cost-Effectiveness Calculation Discussion

REMINDER:

Cost-effectiveness calculations will now be based on particulate matter (PM10), oxides of nitrogen (NOx), and reactive organic gases (ROG). The new formula established by CARB is provided below. **The calculation examples provided in the RFP Appendices do not yet reflect this change.** AQMD staff will calculate the NOx, PM and ROG emissions reductions and apply the new formula during the evaluation process.

Annualized Cost ($/year)

NOx reductions + 10(combustion PM10 reductions) + ROG reductions (tons/year)

The discussion below pertains to the determination of NOx-based cost-effectiveness. A similar approach is used for ROG and PM, and the above formula is used to determine the combined cost-effectiveness for the program funding award and ranking.

For eligible *new* heavy-duty vehicle purchases, only the incremental cost of the new vehicle equipped with an engine that meets the optional NOx emission credit standard compared to a conventional vehicle that meets the existing NOx emission standard is eligible for CMP funding.

For vehicle *repower* projects, eligible costs for funding is the difference between the total installed cost of the newer, replacement engine and the total cost of rebuilding the existing engine. Funding requests for other related repowering equipment such as vehicle transmission will be considered on a case-by-case basis and is at the discretion of the AQMD.

For engine *retrofit* projects, the full cost of the retrofit kit may be funded subject to the $13,600 cost-effectiveness criterion.

For urban transit buses, only 20 percent of the total capital cost, which corresponds to the portion not funded by the Federal Transit Administration (FTA), is eligible for CMP funding, subject to the $13,600 cost-effectiveness criterion. The full incremental cost for an urban transit bus may be granted, however, this will continue to be considered on a case-by-case basis. The transit district must demonstrate its need by need providing CARB with its Transportation Implementation Plan (TIP) and annual updates. If data included in the TIP are not sufficient, the AQMD and CARB can require additional documentation.

Only CMP funds are to be used in determining cost-effectiveness[5]. The one-time incentive grant amount is to be amortized over the expected project life (at least three years) at a discount rate of 3 percent. The amortization formula (given below) yields a capital recovery factor (CRF), which, when multiplied by the initial capital cost, gives the annual cost of a project over its expected lifetime.

$$CRF = [(1 + i)^n (i)] / [(1 + i)^n - 1]$$

where

i = discount rate (3 percent)

n = project life (at least 3 years)

[5] Unless the AQMD "buys down" the cost of the project by adding additional funding, in which case the total grant funding amount should be used for the cost-effectiveness calculation.

Table 1.15 lists the CRF for different project lives using a discount rate of 3 percent. Cost-effectiveness is determined by dividing the annualized costs of a project by the annual NOx emission reductions offered by the project. Example calculations for on-road vehicle projects are provided below.

Table 1.15 – Capital Recovery Factors (CRF) for Various Project Lives At 3 Percent Discount Rate

Project Life	CRF
3	0.354
4	0.269
5	0.218
6	0.185
7	0.161
8	0.142
9	0.128
10	0.117
11	0.108
12	0.100
13	0.094
14	0.089
15	0.084
16	0.080
17	0.076
18	0.073
19	0.070
20	0.067

Project Life

As discussed above, a key parameter in the determination of a project's emission reduction benefit is its project life. The acceptable maximum life for calculating the project benefits of on-road vehicle projects is summarized below in Table 1.16.

Table 1.16 – Maximum Project Life for On-Road Vehicle Projects

Vehicle Type	Default without Documentation	Default with Documentation
School buses ≥ 33,000 GVWR – New	20 years	N/A
Buses ≥ 33,000 GVWR - New	12 years	N/A
Other On-road - New	10 years	15 years
Other On-road - Repowers	7 years	15 years

A project life that is greater than the "default without documentation" limits may be submitted for approval by CARB.

Table 1.1 Verification Classifications for Diesel Emission Control Strategies

Pollutant	Reduction	Classification
PM	< 25%	Not verified
	≥ 25%	Level 1
	≥ 50%	Level 2
	≥ 85%, or ≤ 0.01 g/bhp-hr	Level 3

Only designated engine families for specified model years are compatible with CARB-verified diesel exhaust after-treatment devices. CARB certification levels and information is continually being updated. Applicants are required to submit verification letters as part of the application. Verification letters as well as current information can be found at www.arb.ca.gov/diesel/verdev/verdev.htm.

The program will fund the cost of purchase and installation of a CARB-verified diesel particulate filter, up to a maximum of $8,500, or CARB-verified diesel particulate matter plus NOx after-treatment device, up to a maximum of $18,000

ON-ROAD VEHICLE PROJECT EXAMPLES

In this year's calculations PM and ROG will be included according to the new formula.

Example One - New CNG Vehicle Purchase (Based on Fuel Consumption)

A refuse collection company proposes to purchase a new CNG vehicle versus a diesel vehicle with a GVWR 58,000 lbs and an annual fuel consumption of 10,400 gallons per year. The CNG engine was certified to the new NOx+NMHC emission credit standard of 1.8 g/bhp-hr. This vehicle is used for door-to-door refuse pick-up and operates 100 percent of the time in the South Coast Air Basin.

Emission Reduction Calculation

Baseline NOx Emission factor : 2.5 g/bhp-hr
Baseline NOx Emission Factor (using fuel correction factor (FCF) in Table 1.11):
(2.5 g/bhp-hr)(0.87) = **2.18g/bhp-hr NOx**
Reduced NOx+NMHC Emission Factor: 1.8 g/bhp-hr
Reduced NOx Emission Factor (using default NOx fraction in Table 1.2):
(0.80)(1.8 g/bhp-hr) = **1.44g/bhp-hr NOx**
Energy Consumption Factor: 18.5 bhp-hr/gal (Table 1.13)
Annual Fuel Consumption: 10,400 gal/year
Percent Operated in SCAB: 100 percent
Convert grams to tons: ton/907,200 g

The estimated annual NOx reductions are:

Baseline: (2.18 g/bhp-hr) * 18.5 bhp-hr/gal * 10,400 gal/year * 100 percent * ton/907,200 g = **0.46 ton/yr**
Reduced: (1.44 g/bhp-hr) * 18.5 bhp-hr/gal * 10,400 gal/year * 100 percent * ton/907,200 g = **0.31 ton/yr**

NOx emission reduction: 0.46 ton/yr – 0.31 ton/yr = 0.15 tons/year NOx emissions reduced

In this example, it is noted that the application of a single conversion factor, 18.5 bhp-hr/gal, for the energy content of diesel and CNG fuel is a first-order approximation. If the calculation relied on a CNG-specific conversion factor, annual fuel consumption of CNG, if known for the replacement engine, would be used to calculate emissions from the CNG engine. If the annual CNG consumption is not known, it can be estimated from the baseline diesel engine consumption using the ratio of energy consumption factors as described in the "Stop-and-Go Vehicle" section of this Appendix.

Cost and Cost-Effectiveness Calculations

REMINDER: USE NEW FORMULA ON PAGE 1.

The annualized cost is based on the portion of incremental project costs funded by the CMP, the expected life of the project (10 years), and the capital recovery factor used to amortize the project cost over the project life. The incremental capital cost to the fleet operator for this purchase and the maximum amount that could be funded through the Carl CMP fund are determined as follows:

Incremental Capital Cost: $ 135,000 (new CNG vehicle) - $ 90,000 (new diesel vehicle) = $ 45,000
Maximum Amount Funded: $ 45,000
Capital Recovery Factor: 0.117 (Table 1.15)
Annualized Cost: (0.117)($ 45,000) = $ 5,265/year
Cost-Effectiveness: ($ 5,265/year)/(0.15 tons/year) **= $ 35,100/ton**

IMPORTANT: The cost-effectiveness for the example is greater than the $13,600 per ton cost-effectiveness maximum. In order to meet the $13,600 per ton cost-effectiveness requirement, the funding request should be reduced. To determine the maximum funding request amount allowed by the cost-effectiveness limit, multiply the cost-effectiveness limit ($13,600) by the NOx emissions reduction in tons/year and divide by the Capital Recovery Factor:

($13,600 * 0.15) / 0.117 = $17,436

Thus, this project would only qualify for a portion of the full incremental cost – a maximum amount of $17,436 per vehicle.

Example Two - Urban Bus Purchase (Based on Mileage)

A transit agency proposes to purchase a new (2003 model year) CNG bus instead of a new diesel bus. This new CNG bus is not included in the transit agency fleet average used to determine compliance with CARB transit bus fleet rule. The CNG engine was certified to the new NOx+NMHC emission credit standard of 1.8 g/bhp-hr. The costs of a CNG bus and a diesel bus are $350,000 and $310,000, respectively. The new bus will operate 100 percent of the time within the South Coast Air Basin.

Emission Reduction Calculation

Baseline NOx Emission factor (Table 1.6): 10.2 g/mile
Adjusted Baseline NOx Emission Factor (using fuel correction factor in Table 1.11):
(10.2)(0.87) = 8.87 g/mile
Reduced NOx+NMHC Emission Factor: 1.8 g/bhp-hr
Reduced NOx Emission Factor (using default NOx fraction in Table 1.2):
(0.80)(1.8 g/bhp-hr) = 1.44g/bhp-hr NOx
Unit Conversion Factor: 4.3 bhp-hr/mile (Table 1.10)
Annual Miles: 50,000 miles
Percent Operated in SCAB: 100 percent
Convert grams to tons: ton/907,200 g

The estimated annual NOx reductions are:

Baseline: (8.87 g/mile)* 50,000 miles/year * 100 percent * ton/907,200 g = 0.49 ton/yr
Reduced: (1.44 g/bhp-hr * 4.3 bhp-hr/mile)* 50,000 miles/year * 100 percent * ton/907,200 g = 0.34 ton/yr

NOx Emission Reduction: 0.49 – 034 = 0.15 tons/year NOx emissions reduced

Cost and Cost-Effectiveness Calculations

REMINDER: USE NEW FORMULA ON PAGE 1.

The annualized cost is based on the portion of incremental project costs funded by the CMP, any matching funds that were used to fund the project, the expected life of the project (12 years), and the capital recovery factor used to amortize the project cost over the project life. For urban bus purchases, FTA pays approximately 80 percent of the cost of a new transit bus. The incremental capital cost to the transit agency for this purchase and the maximum amount that could be funded through the CMP fund are determined as follows:

FTA Grant for purchase of new diesel bus:	(0.8)($ 310,000) = $ 248,000
Transit agency's cost for new diesel bus:	$ 310,000 - $ 248,000 = $ 62,000
FTA Grant for purchase of new CNG bus:	(0.8)($ 350,000) = $ 280,000
Transit agency's cost for new CNG bus:	$ 350,000 - $ 280,000 = $ 70,000
Incremental Capital Cost:	$ 70,000 - $ 62,000 = $ 8,000
Max. Amount Funded:	$ 8,000
Capital Recovery Factor:	0.100 (51.11)
Annualized Cost:	(0.100)($ 8,000) = $ 800/year
Cost-Effectiveness:	($ 800/year)/(0.15 tons/year) **= $5,333/ton**

The cost-effectiveness for the example is less than $13,600 per ton of NOx reduced. This project would qualify for the maximum amount of grant funds requested - the incremental cost of what was not funded by FTA. A request for funding for the full incremental cost for a new urban transit bus would be considered on a case-by-case basis. The transit district must demonstrate need by providing AQMD and CARB with its TIP and any annual updates. If data included in the TIP are not sufficient for AQMD and CARB to determine need, additional information will be required.

Example Three – CNG Street Sweeper (Based on Fuel Consumption)

A city municipality proposes to buy a CNG street sweeper in 2003 instead of a diesel street sweeper. The main engine for the proposed street sweeper will be a CNG engine that is certified to the optional NOx+NMHC standard of 1.8 g/bhp-hr, while the auxiliary engine will be an off-road CNG engine certified to an optional NOx+NMHC standard of 4.0 g/bhp-hr (compared to a diesel baseline of 4.9 g/bhp-hr). This vehicle is operated entirely within the South Coast Air Basin. Based on historical fuel usage, the main engine of the street sweeper uses approximately two-thirds of the total fuel consumed with the remaining one-third attributable to the auxiliary engine. This two-thirds/one-third split of the fuel consumption between the main and auxiliary engines, respectively, may be used as a default if actual operational data are not available. The cost of a new CNG street sweeper is $162,000 compared to $122,000 for a new diesel powered street sweeper.

<u>Emission Reduction Calculation</u>

<u>Main Engine</u>:

Baseline NOx Emission factor: 2.5 g/bhp-hr
Adjusted Baseline NOx Emission Factor (using fuel correction factor in Table 1.11):
(2.5)(0.87) = 2.18 g/mile
Reduced NOx+NMHC Emission Factor: 1.8 g/bhp-hr
Reduced NOx Emission Factor (using default NOx fraction in Table 1.2):
(0.80)(1.8 g/bhp-hr) = **1.44g/bhp-hr NOx**

Energy Consumption Factor:	18.5 bhp-hr/gal (1.13)
Annual Fuel Consumption:	5,300 gal/year
Percent Operated in SCAB:	100 percent
Convert grams to tons:	ton/907,200 g

The estimated annual NOx reductions for the main engine are:

Baseline Emissions:
(2.18 g/bhp-hr) * 18.5 bhp-hr/gal * 5,300 gal/year *(2/3)* 100 percent * ton/907,200 g = **0.16 ton/yr**
Reduced Emissions:
(1.44 g/bhp-hr) * 18.5 bhp-hr/gal * 5,300 gal/year *(2/3)* 100 percent * ton/907,200 g = **0.10 ton/yr**

Main Engine NOx Emission Reductions: 0.16 - 0.10 = 0.06 tons/year NOx emissions reduced

Auxiliary Engine:

Baseline NOx+NMHC Emission factor: 4.9 g/bhp-hr
Adjusted NOx Emission Factor
(using default NOx fraction in Table 1.2): (0.95)(4.9 g/bhp-hr) = **4.66 g/bhp-hr NOx**
(using fuel correction factor in Table 1.11): (4.66)(0.87) = 4.05 g/mile

Baseline Emissions:
4.05 g/bhp-hr* 18.5 bhp-hr/gal * 5,300 gal/year *(1/3)* 100% * ton/907,200 g = 0.15 ton/yr

Reduced NOx+NMHC Emission factor: 4.0 g/bhp-hr
Adjusted Reduced NOx Emission Factor
(using default NOx fraction in Table 1.2): (0.8)(4.0 g/bhp-hr) = **3.20 g/bhp-hr NOx**

Reduced Emissions:
(3.2 g/bhp-hr) * 18.5 bhp-hr/gal * 5,300 gal/year *(1/3)* 100% * ton/907,200 g = 0.12 ton/yr

NOx Emission Reduction: 0.15 - 0.12 = 0.03 ton/year NOx emissions reduced

Total Emission Reductions: 0.06 + 0.03 = 0.09 tons/year NOx emissions reduced

Cost and Cost-Effectiveness Calculations

REMINDER: USE NEW FORMULA ON PAGE 1.

The annualized cost is based on the portion of incremental project costs funded by the CMP, any matching funds that were used to fund the project, the expected life of the project (10 years for heavy-duty trucks), and the capital recovery factor used to amortize the project cost over the project life. The incremental capital cost to the fleet operator for this purchase and the maximum amount that could be funded through the CMP are determined as follows:

Incremental Capital Cost:	$ 162,000 - $ 122,000 = $ 40,000
Maximum Amount Funded:	$ 40,000
Capital Recovery Factor:	0.117 (Table 1.15)
Annualized Cost:	(0.117)($ 40,000) = $ 4,680/year
Cost-Effectiveness:	($ 4,680/year)/(0.09 tons/year) **= $ 52,000/ton**

IMPORTANT: The cost-effectiveness for the example is greater than the $13,600 per ton cost-effectiveness maximum. In order to meet the $13,600 per ton cost-effectiveness requirement, the funding request should be reduced. To determine the maximum funding request amount allowed by the cost-effectiveness limit, multiply the cost-effectiveness limit ($13,600) by the NOx emissions reduction in tons/year and divide by the Capital Recovery Factor. For this example, the maximum amount of funding that would still allow the project to meet the cost-effectiveness limit = ($13,600 * 0.09) / 0.117 = $10,461. Thus, this project would only qualify for a portion of the full incremental cost – a maximum amount of $10,461 per vehicle.

Example Four -– New Alternative Fuel Vehicle Purchase (Calculations based on Mileage)

A line haul trucking company proposes to purchase a heavy heavy-duty diesel line haul equipped with a CNG engine certified to 1.8 gm/bhp-hr NOx + NMHC. This vehicle operates 90% of the time in California.

Emission Reduction Calculation

Baseline NOx Emission factor (Table 1.5): 6.7 g/mile
Baseline NOx Emission Factor (using fuel correction factor in Table 1.11):
(6.7 g/mile)(0.87) = **5.83 g/mile NOx**
Reduced NOx+NMHC Emission Factor: 1.8 g/bhp-hr
Reduced NOx Emission Factor
(using default NOx fraction in Table 1.2):
(0.80)(1.8 g/bhp-hr) = **1.44g/bhp-hr NOx**
Conversion Factor: 2.6 bhp-hr/mile (Table 1.10)
Converted Reduced Emission Factor: (1.44 g/bhp-hr NOx)*(2.6 bhp-hr/mi) = 3.74 g/mile NOx
Annual Miles: 60,000 miles
Percent Operated in CA: 90%
Convert grams to tons: 1 ton = 907,200 g

The estimated reductions are:

Baseline: (5.83 g/mile) * 60,000 mile/year * 90% * ton/907,200 g = 0.347 ton/yr
Reduced: (3.74 g/mile) * 60,000 mile/year * 90% * ton/907,200 g = 0.222 ton/yr

NOx Emission Reductions: 0.347 – 0.222 = 0.125 tons/year NOx emissions reduced

Cost and Cost-Effectiveness Calculations

REMINDER: USE NEW FORMULA ON PAGE 1.

The annualized cost is based on the portion of incremental project costs funded by the CMP, any matching funds that were used to fund the project, the expected life of the project (10 years default life for heavy-duty trucks), and the capital recovery factor used to amortize the project cost over the project life. The incremental capital cost to the fleet operator for this purchase and the maximum amount that could be funded through the CMP fund are determined as follows:

Incremental Capital Cost: $ 135,000 (new CNG vehicle) - $ 90,000 (new diesel vehicle) = $ 45,000
Maximum Amount Funded: $ 45,000
Capital Recovery Factor: 0.117 (Table 1.15)
Annualized Cost: (0.117)($ 45,000) = $ 5,265/year
Cost-Effectiveness: ($ 5,265/year)/(0.125 tons/year) **= $42,120/ton**

The cost-effectiveness for the example exceeds the $13,600 per ton cost-effectiveness requirement. In order to meet the $13,600 per ton cost-effectiveness requirement, this project would only qualify for about $14,530, a fraction of the incremental cost. This amount is determined by multiplying the maximum allowed cost-effectiveness by the estimated annual emission reductions and dividing by the capital recovery factor (i.e., 13,600*0.125/0.117).

Example Five – New LNG Refuse Hauler Purchase (Calculations Based on Fuel Consumption)

The following example shows two different ways to calculate emission benefits[6] for projects involving alternative-fuel engines. First, by using different energy consumption factors for diesel and LNG engines and their corresponding annual fuel consumption. Second, by using the same default ECF and diesel fuel baseline usage.

A refuse collection company proposes to purchase a new LNG vehicle versus a diesel vehicle with a GVWR of 58,000 lbs. The LNG engine was certified to the new NOx+NMHC emission credit standard of 1.8 g/bhp-hr. The fleet operator currently operates both diesel and LNG trucks and has specific information on the annual amount of diesel and LNG used per truck (19,900 gallons diesel and 35,000 gallons LNG per diesel and LNG truck, respectively). The fleet operator wants to use an ECF of 10.5 bhp-hr/LNG gal for the LNG engine (see discussion in the Emission Reductions and Cost-Effectiveness section of this chapter). This vehicle is used for door-to-door refuse pick up and operates 100 percent of the time in California.

<u>Emission Reduction Calculation (Method 1)</u>

Baseline NOx Emission factor: 2.5 g/bhp-hr
Baseline NOx Emission Factor
(using fuel correction factor in Table 1.11): (2.5 g/bhp-hr)(0.87) = **2.18g/bhp-hr NOx**
Reduced NOx+NMHC Emission Factor: 1.8 g/bhp-hr
Reduced NOx Emission Factor
(using default NOx fraction in Table 1.2): (0.80)(1.8 g/bhp-hr) = **1.44g/bhp-hr NOx**
Energy Consumption Factor: 18.5 bhp-hr/gal (Table 1.13)
Annual Diesel Fuel Consumption: 19,900 gal/year
% Operated in CA: 100 %
Convert grams to tons: ton/907,200 g

The estimated emission reductions are:
Baseline: 2.18 g/bhp-hr * 18.5 bhp-hr/gal * 19,900 gal/year * 100% * ton/907,200 g = **0.88 ton/yr**
Reduced: 1.44 g/bhp-hr * 18.5 bhp-hr/gal * 19,900 gal/year * 100% * ton/907,200 g = **0.58 ton/yr**

NOx emission reduction: 0.88 ton/yr – 0.58 ton/yr = 0.30 tons/year

[6] Cost-effectiveness is not addressed in this example.

Emission Reduction Calculation (Method 2)

Baseline NOx Emission factor: 2.5 g/bhp-hr
Adjusted Baseline NOx Emission Factor
(using fuel correction factor in Table 1.11): (2.5 g/bhp-hr)(0.87) = **2.18g/bhp-hr NOx**
Reduced NOx+NMHC Emission Factor: 1.8 g/bhp-hr
Adjusted Reduced NOx Emission Factor
(using default NOx fraction in Table 1.2): (1.8 g/bhp-hr)(0.80) = **1.44g/bhp-hr NOx**
ECF (new diesel engine): 18.5 bhp-hr/gal
ECF (new LNG engine): 10.5 bhp-hr/LNG gal
Annual Diesel Fuel Consumption: 19,900 gal/year
Annual LNG Fuel Consumption: 35,000 gal/year
% Operated in CA: 100 %
Convert grams to tons: ton/907,200 g

The estimated emission reductions are:
Baseline emissions: 2.18 g/bhp-hr * ***18.5 bhp-hr/gal * 19,900 gal/year*** * 100% * ton/907,200 g = **0.88 t/y**
Reduced emissions: 1.44 g/bhp-hr * ***10.5 bhp-hr/gal * 35,000 gal/year*** * 100% * ton/907,200 g = **0.58 t/y**

NOx Emission Reductions: 0.88 – 0.58 t/y = 0.30 ton/year

This example illustrates two methods for calculating emissions: first, using the same ECF for both diesel and LNG engines, and, second, using separate ECFs, 10.5 bhp-hr/gal for LNG engine and 18.5 bhp-hr/gal for diesel engine. As shown in this example, both methods yield the same result.

CHECK LIST FOR APPLICATION ITEMS – On-Road Vehicles

Be sure the following items are included with your application submittal. Check each applicable item below to indicate inclusion of material.

- ❑ Completed Application Forms
- ❑ Project cost information (as described in the RFP) which shall include vendor quotes or other documentation substantiating cost data provided in Application.
- ❑ Contracting Statements (Applications are not eligible without this form.)
  - ❑ Statement of Understanding for Work Statement and Deliverables
  - ❑ Conflict of Interest Statement (as described in the RFP)
  - ❑ Third-Party Application Submittal Authorization (Only required if application is submitted by someone other than the vehicle/equipment owner.)
- ❑ Letter of Agreement from Fuel Provider to provide your proposed fleet with alternative fuel (unless you have an existing station).
- ❑ Co-funding information attachments to the application (if applicable)
- ❑ Certifications and Representations, which can be downloaded from http://www.aqmd.gov/rfp/index.html
- ❑ Activity justification documentation (i.e., mileage logs, fuel receipts, etc.).
- ❑ CARB Executive Order
- ❑ Other (attach explanation)

If you have any questions regarding the application process for On-Road Heavy-Duty Vehicles, please contact Connie Day, Science & Technology Advancement at (909) 396-3055 by phone, or (909) 396-3252 by fax.

REMINDER

Due Date - The proposer shall submit **six (6) complete copies of the proposal** in a sealed envelope, plainly marked in the upper left-hand corner with the name and address of the proposer and the words "Request for Proposals #P2006-01." All proposals are due no later than **2:00 p.m., on Friday September 30, 2005**. Postmarks are not accepted. **Faxed or e-mailed proposals will not be accepted**. Proposals must be directed to:

Procurement Unit
South Coast Air Quality Management District
21865 East Copley Drive
Diamond Bar, CA 91765

CONTRACTING STATEMENTS
(NOTE: This form is required, regardless of the status of item 3.)

1. Statement of Understanding for Work Statement and Deliverables

In order to minimize the effort required to complete a CMP Application, AQMD does not require submittal of a Work Statement or Deliverables Summary with the Application. However, the undersigned confirms full understanding that, if awarded funding under the Carl CMP, development and submittal of the detailed work statement, with deliverables and schedule, is a requirement of the contracting process. Recommended projects will not receive funding without these documents. Full details of the Work Statement and Deliverables requirements are detailed in RFP# P2006-01. In addition, Baseline and Reduced Emission Vehicle Serial/VIN information must be provided at contract start. By signing below, the applicant acknowledges these requirements.

2. Conflict of Interest Statement

Please address any potential conflicts of interest with other clients affected by actions performed by the firm on behalf of the AQMD in the form of a Conflict of Interest Statement. Although the proposer will not be automatically disqualified by reason of work performed for such firms, the AQMD reserves the right to consider the nature and extent of such work in evaluating the proposal. Conflicts of interest will be screened on a case-by-case basis by the AQMD District Counsel's Office. Conflict of interest provisions of the state law, including the Political Reform Act, may apply to work performed pursuant to this contract. Please provide a Conflict of Interest Statement below. If additional room is necessary, please attach extra pages to this sheet.

3. Third-Party Application (Circle One: Applicable Not Applicable)

Applicants who are submitting on behalf of a vehicle/equipment owner must provide authorization from the vehicle/equipment owner to act on their behalf for this application process. This authorization shall be provided in the form of a "Letter of Exclusive Authorization", to be attached to this sheet. In addition, the vehicle/equipment owner shall enter into a contract with its authorized applicant, who will sign a contract with AQMD for fulfilling all contract obligations.

Organization:	
Printed Name of Responsible Party:	Title:
Signature of Responsible Party:	Date:

South Coast Air Quality Management District Moyer Program
2005 Application Form for use with RFP#2006-01

Instructions: ➢ Read the SCAQMD Moyer Program RFP#2006-01 for instructions and additional important information. ➢ Fill in all applicable sections with ink. Please print legibly. Return application to**: Procurement Unit** **South Coast Air Quality Management District** **21865 East Copley Drive** **Diamond Bar, CA 91765** **DEADLINE: Received at SCAQMD by** **Friday, September 30, 2005 at 2:00PM** **(no exceptions)**	Application # _____ *For internal use.*

Applicant Information (☐ Check here if this is a Third-Party Application.)

Company Name		**Mailing Address**			
Contact Person		**City**		**State**	
Title		**ZIP**		**County**	
Phone Number		***Fill in physical address below if equipment is based at an address that is different from mailing address***			
Fax Number		**Physical Address**			
E-mail Address		**City**		**State**	
Cell Number		**ZIP**		**County**	
Tax ID (Check One)	☐ Federal Employers Identification Number (FEIN)		---		
	☐ Individual or Sole Proprietor		---	---	

Name of person who will sign the Funding Agreement:
(please print) Title:

Equipment Type (check one): ☐ On-road ☐ Off-road ☐ Locomotive
☐ APU ☐ Ag Pump ☐ Marine ☐ Forklift ☐ TSE ☐ Other: _____

Vehicle / Equipment / Engine Vendor Information (or attach business card)

Contact		**Address**			
Company		**City**		**State**	
Phone		**ZIP**			
FAX		**E-mail**			

TOTAL GRANT REQUEST (for entire project): $

Please initial each section (See RFP# 2006-01 for additional information and requirements):

_____	The purchase of this low-emission technology is **NOT** required by any local, state, and/or federal rule or regulation.
_____	The definitions of qualifying projects are described in RFP #2006-01. These definitions have been reviewed and this application is consistent with those definitions.
_____	The vehicle/engine will be used within the SCAQMD boundaries (with the emission reduction system operating) for at least the projected usage shown in this application, and no less than 75 percent of the time.
_____	All project applicants must submit documentation that supports the activity claimed in the application (i.e., fuel receipts, mileage logs and/or hour-meter readings covering the last two years). This documentation is attached.
_____	The grant contract language can not be modified without the written consent of all parties. I have reviewed and accepted the contact language.
_____	I understand that an IRS Form 1099 will be issued to me for incentive funds received under the Moyer Program. I understand that it is my responsibility to determine the tax liability associated with participating in the Moyer Program.
_____	I understand that a SCAQMD-funded Global Positioning System (GPS) unit will be installed on vehicles/equipment not operating within SCAQMD boundaries full time. I will submit data as requested and otherwise cooperate with all data reporting requirements. I also understand that the additional cost of the GPS unit will be added to the project cost when calculating cost-effectiveness, though the SCAQMD will pay for this system directly.
_____	I understand that the SCAQMD has the right to conduct unannounced inspections for the full project life to ensure the project equipment is fully operational at the activity level committed to by the contract.
_____	I understand that all emission reductions resulting from funded projects will be retired. To avoid double counting of emission reductions, project vehicles and/or equipment may not receive funding from any other government grant program that is designed to reduce mobile source emissions.
_____	I understand that a tamper proof, non-resettable digital hour meter/odometer must be installed on all vehicles/equipment and that the digital hour meter/odometer will record the hours/miles accumulated within the SCAQMD boundaries. This cost is my responsibility.

Application Statement – Please Read and Sign

All information provided in this application will be used by SCAQMD staff to evaluate the eligibility of this application to receive program funds. SCAQMD staff reserves the right to request additional information and can deny the application if such requested information is not provided by the requested deadline. Incomplete or illegible applications will be returned to applicant or vendor, without evaluation. An incomplete application is an application that is missing information critical to the evaluation of the project.

- I certify to the best of my knowledge that the information contained in this application is true and accurate.

- I understand that it is my responsibility to ensure that all technologies are either verified or certified by the California Air Resources Board (CARB) to reduce NOx and PM pollutants.

- I understand that there may be conditions placed upon receiving a grant and agree to refund the grant (or pro-rated portion thereof) if it is found that at any time I do not meet those conditions and if directed by the SCAQMD in accordance with the contract agreement.

- I understand that I will be prohibited from applying for any other form of emission reduction credits for Moyer-funded vehicles/engines, including: Emission Reduction Credit (ERC); Mobile Source Emission Reduction Credit (MSERC) and/or Certificate of Advanced Placement (CAP), for all time, from the SCAQMD, CARB or any other Air Quality Management or Air Pollution Control District.

- In the event that the vehicle(s)/equipment do not complete the minimum term of any agreement eventually reached from this application, I agree to ensure the equivalent project emissions reductions, or to return grant funds to the SCAQMD as required by the contract.

- I have the legal authority to apply for grant funding for the entity described in this application.

- I have reviewed and responded to (as appropriate) all three sections of the Contracting Statements form.

- Applicants who are submitting an application on behalf of a vehicle/equipment owner must provide authorization from the vehicle/equipment owner to act on their behalf for this application process. This authorization is provided in the form of a "Letter of Exclusive Authorization" that is attached to the Contracting Statements form. It is understood that the vehicle/equipment owner shall enter into a contract with its authorized applicant, who will sign a contract with AQMD for fulfilling all contract obligations. A copy of this contract is required prior to execution of a grant funding agreement.

_____ _____

Applicant's Signature **Date**

_____ _____

Applicant's Name (please print) **Title**

Vehicle / Equipment Information Form (page 1 of 3)

(Please submit separate Information Form for each type of vehicle/equipment)

Vocation(s) (Please list project vehicle/equipment use): _____

Number of Units of this per type): _____

Equipment Type (check one):

☐ On-road ☐ Off-road ☐ Locomotive
☐ APU ☐ Ag Pump ☐ Marine ☐ Forklift ☐ TSE ☐ Other: _____

Project Life (equipment must operate for this full life): _____
(see RFP appendices for default project life values)

Project Area (percent of time project will operate in SCAQMD boundaries): _____

Project Type (check all that apply for this vehicle):

☐ **Engine repower** ☐ **Engine retrofit** ☐ **Other** ☐ **New low-emission vehicle**
☐ **Check here if project vehicle is a stop-and-go vehicle as defined in the RFP.**

CARB Load Factor defaults will be used unless documentation to support an alternative load factor is attached. Alternative Load Factor (if desired): _____

Main Location of operation (include cross streets, harbor and berth location or other landmarks)	

Annual Vehicle/Engine Usage (Activity) Information (Attach supporting documentation to support this activity level and understand that you must achieve this level of activity each year for the entire project life.):

Miles/Year	
Hours/Year	
Gallons/Year	

☐ **Check here to indicate that activity verification documentation is attached.**

☐ **Check here to indicate that proposed engines or equipment are not part of an averaging, banking and trading program (ABT) or other fleet average program.**

☐ **Check here to indicate an ARB Executive Order for the proposed equipment is attached.**

Vehicle / Equipment Information Form (page 2 of 3)

(Please submit separate Information Form for each type of vehicle/equipment)

Existing Vehicle and Main Engine Information (for repowers or retrofits)

Vehicle Make:	Vehicle Model:	Model Year:	GVWR:
Vehicle Identification Number:	Fleet Identification Number:	License Plate:	Odometer:

Main Engine Make:	Main Engine Model:	Model Yr:	Serial Number:	HP: ___ KW:___	Hour Meter:
Auxiliary Engine Make:	Aux. Engine Model:	Model Yr:	Serial Number:	HP: ___ KW:___	Hour Meter:
Total number of engines per vehicle/equipment:_____					
Existing Engine Fuel Type: ☐ CNG ☐ Diesel ☐ LNG ☐ LPG ☐ Gasoline ☐ Other:					

New Vehicle/Engine Information (Provide all available information)

Vehicle Make:	Vehicle Model:	Model Year:	GVWR:
Vehicle Identification Number:	Fleet Identification Number:	License Plate:	Odometer:

Engine Make:	Engine Model:	Model Yr:	Serial Number:	HP:__ KW:__	Hour Meter:
New equipment fuel type: ☐ CNG ☐ Diesel ☐ LNG ☐ LPG ☐ Gasoline ☐ Electricity ☐ Other:					

Vehicle / Equipment Information Form (page 3 of 3)
Project Cost Information

Attach vendor quotes, vehicle valuations, repair estimates (including a detailed breakdown of labor cost) and any other documentation needed to justify project costs.

Engine Repower Costs	
1. New Lower-Emission Engine	
2. Total Unique Parts	
3. Other Parts	
4. Labor Cost (if requested)	
5. Existing Engine Rebuild Parts Cost	
6. Existing Engine Rebuild Labor Cost	
Maximum Grant Request =[1+2-(5+6)]	

Engine Retrofit Costs	
1. Engine Retrofit Parts Cost	
2. Engine Retrofit Labor Cost	
Maximum Grant Request (=1+2)	

New Low-Emission Vehicle (LEV)/Equipment Purchase	
1. New LEV Purchase Cost	
2. New non-LEV Purchase Cost	
Maximum Grant Request (=1-2)	

Supporting Eligible Equipment Purchase (i.e., battery pack, installation, TSE, etc. as allowed by ARB and the RFP)	
1. Supporting Eligible Equipment Cost	
Maximum Grant Request (=1)	